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The application of bar cooling technology to plate mills for throughput and utilization improvements

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Recent trends in plate steel production have seen a focus on maximizing mill productivity. Plates that are produced using a controlled rolling strategy usually have a pause in the rolling sequence. This hold time can be extended based on the process parameters and can significantly contribute to the overall production time for a single plate and reduce mill productivity. The application of water cooling to the semi-hot rolled plate, or transfer bar, increases the rate of heat removal during the hold period. The result is that the temperature of bar is reduced faster, allowing rolling to resume earlier and mill productivity to be recovered.

This paper describes a recent application of Bar Cooling technology at the plate mill line at Hyundai Steel Corporation's Danjing Works. Hyundai and Primetals Technologies worked closely to install the system during a single shutdown. Startup and commissioning to full production and final acceptance tests was carried out over a 6-week period.

A description of the process, including the Bar Cooling System, the principles of water cooling during high temperature rolling and associated automation is provided. A flexible cooling strategy that determines the total cooling time by modifying the cooling speed and the number of cooling passes was implemented. The total cooling time was modelled to include the recovery time to a maximum equalization temperature prior to the resumption of rolling.

This paper also demonstrates the importance of advanced model-based automation to calculate the temperature-time evolution for thick transfer bars with a detailed knowledge of the water to steel surface heat transfer coefficient. This is coupled with a Level 1 automation solution to deliver the tracking and sequencing required for accurate control. Finally, off-line simulations of the bar cooling process are carried out using a Digital Twin with key results from these simulations presented and discussed.

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